SMART AGRICULTURE BASED IOT AND MOBILE APPS

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ABSTRACT

Agriculture is the main occupation in our country for many centuries. But now because of the migration of people from rural to urban areas there are barriers to agriculture. So to solve this problem we are using smart farming techniques using IOT. Smart farming is a developing concept, because the IOT Sensor is able to provide information about the agricultural sector and then act on user input. To develop this Intelligent Agricultural System, it uses the advantages of the latest technology such as Arduino, IOT and Wireless Sensor Networks. The paper aims to make use of the emerging technology namely IOT and the use of intelligent agricultural automation. Monitoring of environmental conditions is the main factor for increasing efficient crop yields. This feature includes the development of a system that can monitor temperature, humidity and is programmed via an android application.

KEYWORDS
Smart agriculture
IOT
Arduino
Mobile Apps

1. Introduction

Agriculture is considered the basis of human life because it is the main source of raw materials for food, grains and others. This supports an important role in the country's economic growth, and also provides employment in sizable rural areas. Growth in the agricultural sector is necessary for the development of the country's economic conditions. Unfortunately, many farmers still use traditional farming methods with low yields. As the world is trending into new technologies and implementation it is a necessary goal for agricultural trends as well. Much research has been carried out in agriculture. Most of the projects signaled the use of networked wireless sensors, collecting data from various sensors used at various nodes and transmitting them via wireless protocols. The data collected provides information on various environmental factors. Monitoring environmental factors is not a complete solution to increasing crop yields. There are a number of other factors that reduce productivity to a greater extent. Therefore, automation must be applied in agriculture to overcome these problems. That way, it can provide solutions to all problems such as the need to develop an integrated system that will be taken, paying attention to all factors that affect productivity at each stage. Wherever automation has been implemented and humans have been replaced by automated machines, yields have increased. Therefore it is necessary to apply modern science and technology in agriculture. Much of the discussion of this paper signifies the use of a wireless sensor network which collects data from different types of sensors and then sends it to the main server using a wireless protocol. The data collected provides information on various environmental factors that come in to help monitor the system. Environmental factor monitoring is not sufficient and complete solution to increase crop yields.

There are several factors that greatly affect productivity. These factors include 1. Insect and pest attacks that can be controlled by spraying the plants with the right insecticides and pesticides 2. Attack of wild animals and birds when the plants are big 3. There is also the possibility of theft when the plants are at the harvest stage 4. Even after harvest time, farmers also faced problems in storage of harvested crops. So, to provide solutions to these problems, it is necessary to develop an integrated system that will handle all the factors that affect productivity at each stage such as; cultivation, harvest and post harvest storage. Therefore this paper proposes as a system that is useful for monitoring field data, as well as controlling field operations that provides flexibility. This paper aims to make smart agriculture using automation and IoT technologies. Highlights Features of this paper include remote controlled mobile apps to perform tasks such as; Weeding, spraying, moisture sensing, Control all these operations will be via a remote smart device or Internet connected computer and operations will be carried out by interface sensors and Nodecmu.

The research was conducted by Adrian Reza, Hermanto, Joko Purnomo, Surya Atmajaya, and Ridhan Herawan with the research title "Internet Of Things Based Mushroom Cultivation System Using Telegram Bot". The research was conducted by building a remote control device with Esp 8266 to access local controls with the help of an Artificial Intelligence Chatbot using Telegram Messenger. to provide information to farmers via telegram messenger notifications and notify the status of temperatures that may decrease or increase and farmers can activate sprays to control temperature through smartphones. And use CCTV to monitor the growth of fungi [1]

Further research was made by Andi Heryanto, Jian Budiarto and Sirojul Hadi with the research title "Internet Of Things Based Hydroponic Plant Nutrition System Using NodeMCU ESP8266". Technology that suits plant nutrition systems that can provide plant nutrition automatically and can be monitored using ioT (Internet of Things) concepts. The sensors used in the study are the MPS340 PH sensor and the DS18B20 temperature sensor that serves to determine the PH and temperature of the water used in hydroponic plants. The primary control system uses mcu nodes integrated with the ESP8266 WiFi module to connect to the internet network. The actuator used is the cellenoid valve. The results achieved after this study was carried out is a system of providing nutrients to hydroponic plants that make it easier for urban co mmunities to grow crops with solid time in order to improve crop success and the quality of hydroponic plants. [2]

The research was conducted by Ummi Syafiqoh, Sunardi and Anton Yudhana with the research title "Development of Internet of Things-Based Wireless Sensor Network for Water and Agricultural Soil Monitoring Systems". One solution so that water and soil quality can be monitored and managed efficiently is to utilize the Internet of Things (IoT) based Wireless Sensor Network. The use of ESP8266 Module as a WIFI module, widely utilized by Internet of Things-based applications because it is cheap so that it reduces many costs and has a fairly good speed of 80 MHz. This research aims to develop the concept of Wireless Sensor Network by utilizing the ESP8266 module to monitor the pH value using the pH Meter Analog Kit sensor and the temperature of the farm using the DS18B20 Waterproof sensor. The result of temperature measurement accuracy using the DS18B20 Waterproof sensor from the designed system is 99.09% while the pH measurement uses a pH Meter Analog Kit sensor of 91.33%. [3]

In making this smart agriculture remote control system tool, it uses Nodecmu as the main control (server) to control the 4 channel Relay module that is connected to the water pump to be controlled. Watering equipment that can be controlled via a smartphone connected to the internet. For controlling plant watering from a Smartphone it can be directly controlled, while for controlling plant watering from a smartphone through an application or platform Bylink-IoT for Arduino, ESP8266 / 32, Raspberry Pi which has been paired on the smartphone.

- Internet Of Things (IOT)

Internet of Things (IOT) is a concept where certain devices have the ability to be able to communicate with other devices through a network without requiring human interaction or intervention. In its use, IOT is often found in various activities, such as the number of online transportation, e-commerce, online ticket ordering, live streaming, e-learning and others and even tools to help in certain areas such as remote temperature sensors, GPS tracking, and so on. use the internet or network as a medium to do it.[4]

Fig. 1. Internet of Things (IoT)

- NodeMCU

NodeMCU is an IoT platform that is opensource. Consists of hardware in the form of a System On Chip ESP8266. of the ESP8266 by Espressif System, as well as the firmware used, which uses the Lua scripting programming language. [Sumardi, 2016] The term NodeMCU by default actually refers to the firmware used instead of the hardware development kit. NodeMCU can be analogized as the ESP8266 arduino board. [5]

Fig. 2. NodeMCU

- Relay

Relay is a device that works using the electromagnetic principle to drive a number of arranged contactors or an electronic switch that can be controlled from other electronic circuits by utilizing a small electric current (low power) as an energy source to deliver higher voltage electricity. In principle, the relay is a switch lever with a wire wound on the iron rod (solenoid) nearby. When an electric current is applied to the solenoid, the lever will be pulled because of the magnetic force that occurs on the solenoid so that the switch contacts will close. When the electric current is stopped, the magnetic force will be lost, the lever will return to its original position and the switch contacts open again. [6]

Fig. 3. Relay 4 Channel

- Soil Moisture Sensor

Soil Moisture Sensor is a module for detecting soil moisture, which can be accessed using a microcontroller such as Arduino. This soil moisture sensor can be used in agricultural systems, plantations, and hydroponic systems using hydrotons.[7]

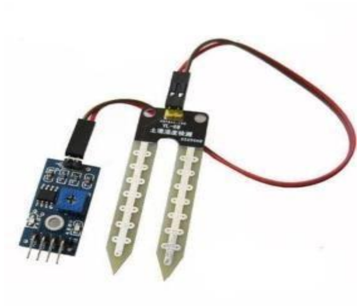

Fig. 4. Soil Moisture Sensor

- LCD Display

LCD (Liquid Cristal Display) is a type of electronic display made with CMOS logic technology that works by not producing light but reflecting the light around it against the front-lit or transmitting light from the back-lit. LCD (Liquid Crystal Display) functions as a data viewer in the form of characters, letters, numbers or graphics. [8]

Fig. 5.LCD Display

- Mini Dipping Water Pump

A pump is a tool or machine that is used to move liquids from one place to another through a piping medium by adding energy to the fluid that is moved and continuously. [9]

Fig. 6. Mini Dipping Water Pump

- Bylink

Blynk is an application for iOS and Android OS to control Arduino, NodeMCU, Raspberry Pi and the like over the Internet. This application can be used to control hardware devices, display sensor data, store data, visualize, and others. The Blynk application has 3 main components, namely Applications, Servers, and Libraries. Blynk server functions to handle all communication between smartphones and hardware. The widgets available on Blynk include Button, Value Display, History Graph, Twitter, and Email. Blynk is not tied to several types of microcontrollers but must be supported by the selected hardware. NodeMCU controlled by Internet via WiFi, the ESP8266 chip, Blynk will be made online and ready for the Internet of Things.[10]

Fig. 7. Bylink

2. Method

The methods used in data collection in this study are carried out in the following ways:

The library method, in which the authors take references from published international journals (IEEE) and other sources of information on the internet related to the theories used as references in this study. The test method, which is done via a smartphone (bylink). When one of the bylinks (for smartphones) is pressed, the command (signal) sent to nodemcu will be processed, then your nodec sends a command signal to the relay to run, so that when the relay runs the command, the relay can connect or cut off the current to the load (pump). The data analysis method is done by measuring the output voltage of each GPIO Nodemcu (Vdc) pin connected to the relay input, and also measuring the output voltage from the relay output (Vac) connected to the pump. In this study, several stages were also carried out so that the process of making this smart agriculture tool would run smoothly and the objectives of the study could be achieved, namely by making a flowchart.

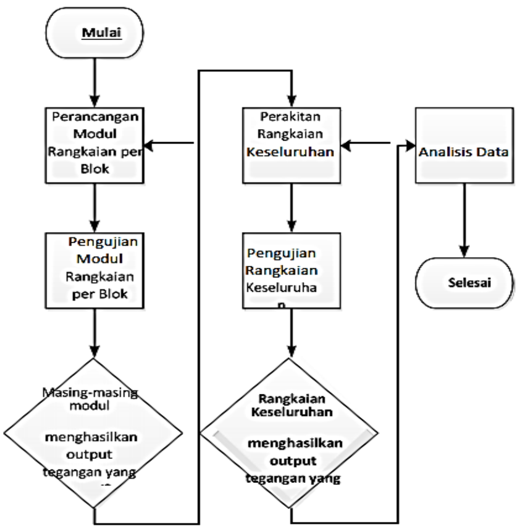

Fig. 8. Flowchart Diagram

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Before making the actual smart agriculture tool, previously the overall block diagram design was carried out and the wiring scheme of the whole circuit system diagram was designed as follows:

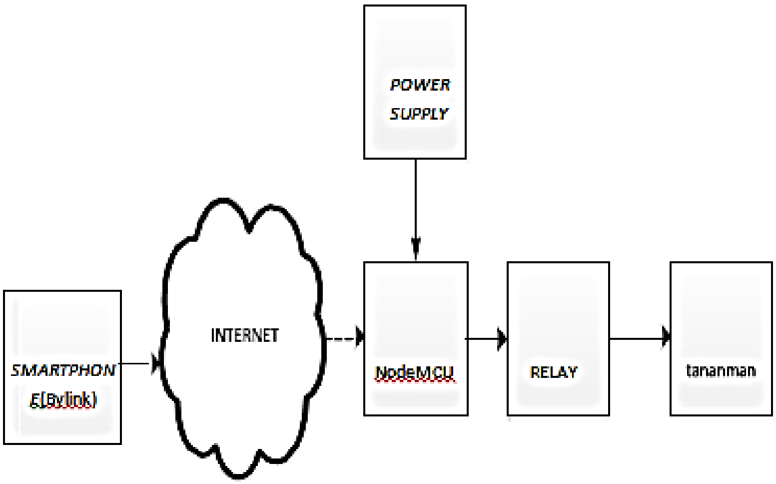

Fig. 9. Overall Circuit Diagram Block Desig

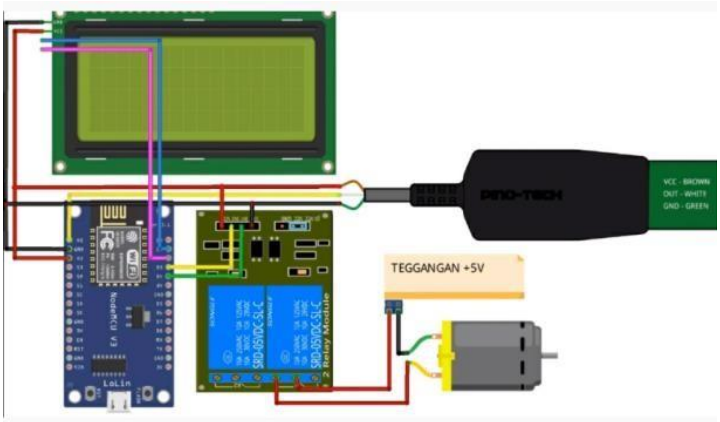

Fig. 10. Overall Circuit Diagram Block Des

3. Results and Discussion

After designing the entire block diagram circuit and designing the wiring scheme for the entire circuit system, a smart agriculture tool is actually produced as follows:

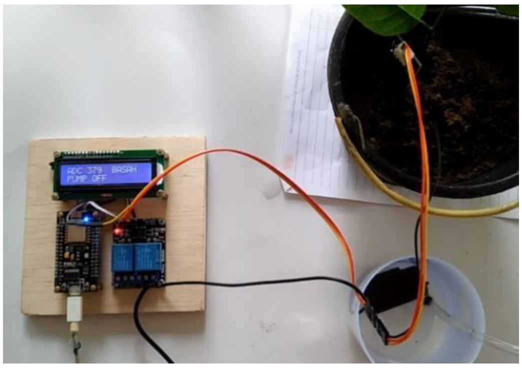

Fig. 11. Overall Circuit Design

1. Testing via smartphone
   - Testing on NodeMCU
   - Testing on RelaysPengujian
2. Testing the whole system via smartphone done by installing the Bylink platform on an Android-based smartphone or you can also use an iOS-based smartphone. Cayenne can be downloaded on the playstore for smartphones based on Android or can be downloaded via the App Store for smartphones based on iOS.

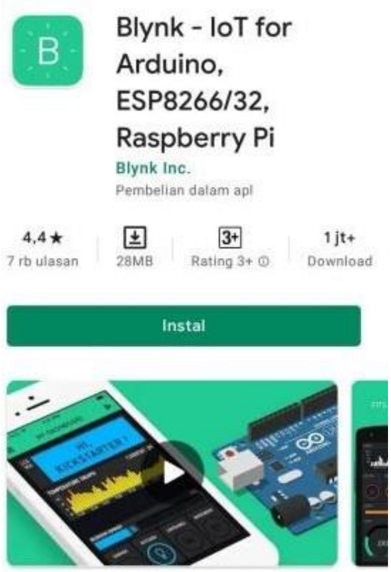

Fig. 12. Installing Bylink on a Smartphone

After Bylink has been successfully installed on a smartphone, the next step is creating an account, which will be used to log in so that you can access your Nodec online. After logging in with the account that has been created, choose the Rasi device and make sure your Nodec is on and connected to the internet so that it can be detected when searching for devices.

Fig. 13. Create an account

After creating an account, then log in to create a new project and create a project name.

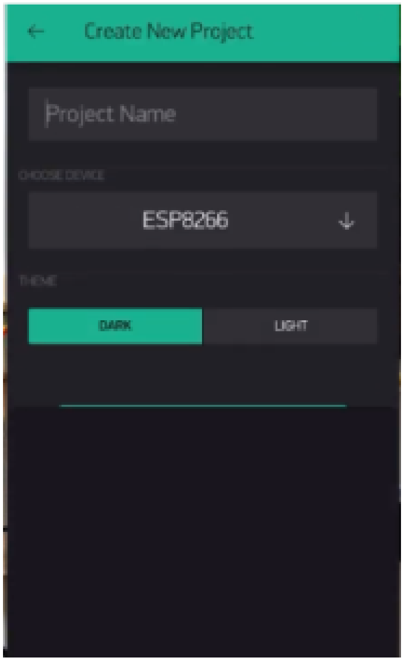

Fig. 14. Create a new project

Next, testing Nodemcu using a smartphone. At the initial stage the program is made so that the system is able to detect the condition of the object under study through the installed sensor. The parameter values for the conditions specified for integration in the system can be seen in table 1.

Table 1. Temperature and humidity parameters

Temperature (^{0}c)	Information	Humdity (%)	Information
< 20° C	Not Good	< 40%	Low
≤ 30° C	Good	≤ 60%	Normal
> 30° C	Not Good	> 60%	Good

3.1. DHT-11 sensor testing

The DHT-11 sensor is tested by placing it at a certain point around the test environment

Table 2. Temperature and humidity parameters

Time	Temperature	Humidity	Information
07.00	26^O	81%	B/B
08.00	27^O	78%	B/B
09.00	27^O	77%	B/B
10.00	28^O	72%	B/B
12.00	32^O	66%	K/B
14.00	31^O	67%	K/B
15.00	31^O	65%	K/B
17.00	29^O	69%	B/B
18.00	27^O	76%	B/B
20.00	26^O	83%	B/B

Based on the data in table 2, it can be seen that the conditions of temperature and humidity have values that vary according to the time of taking the test sample. Overall, the values obtained are in good range conditions (B), namely temperature <= 300 and soil moisture> 60%. However, there was an unfavorable range of conditions (K), namely when the test sample was taken, the time range was 12.00 s.d. 15.00 noon.

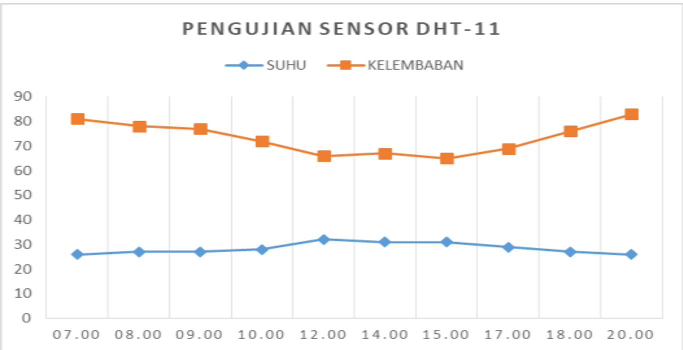

Fig. 15. DHT-11 sensor test chart

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3.2. Soil moisture sensor testing

Soil moisture sensor is tested by planting it at a certain point around the test environment.

Table 3. Testing of soil moisture sensors

Time	Kelembaban Tanah	Information
07.00	73%	B
08.00	73%	B
09.00	71%	B
10.00	67%	B
12.00	61%	B
14.00	58%	C
15.00	60%	C
17.00	64%	B
18.00	66%	B
20.00	70%	B

Based on the data in Table 3, it can be seen that the soil moisture conditions have varying values based on the time of taking the test samples. Overall, the value obtained is in a good range (B), namely> 60%. The test conditions with a fairly good category (C) were obtained at 14.00 - 15.00 noon.

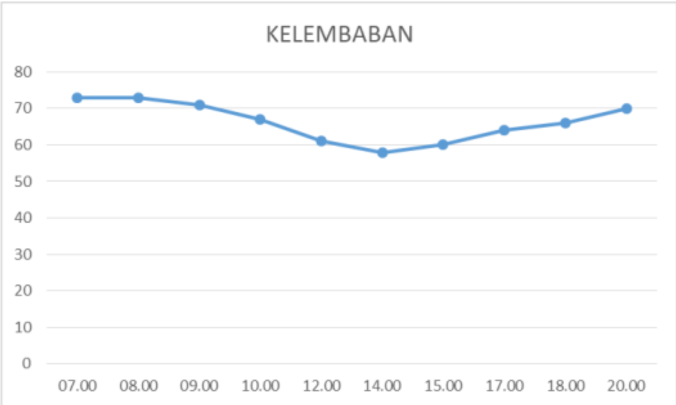

Fig. 16. Soil sensor test graph

The testing phase of the Nodemcu and Relay circuits has been completed and the results are in accordance with the design, for the next stage is testing the entire system which is carried out as follows: Through testing is done by operating the buttons that have been made. When the condition of the smartphone screen button is on, it indicates that the output on the relay is on or in the ON position, while when the button is off, it indicates that it is in the OFF position or not on voltage. In the results of testing the entire system that has been carried out, it shows that the design and manufacture of smart agriculture tools is going well. Automatic watering according to the command given via smartphone.

4. Conclusion

With this smart farm farmers can get maximum results and reduce costs and power. In small-scale people's plantations, the current system of monitoring and management of plantation land still conventionally relies on human labor which results in productivity and efficiency is difficult to improve, slow decision making, and the trend of future plantation conditions cannot be predicted. With the application of smart agriculture, mobile apps and gis farmers can get satisfactory produce, the more efficiency and productivity can be achieved.

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